

## Multi-kW Uplink Fiber-Laser Beacon with Agile Signal Format, Phase II

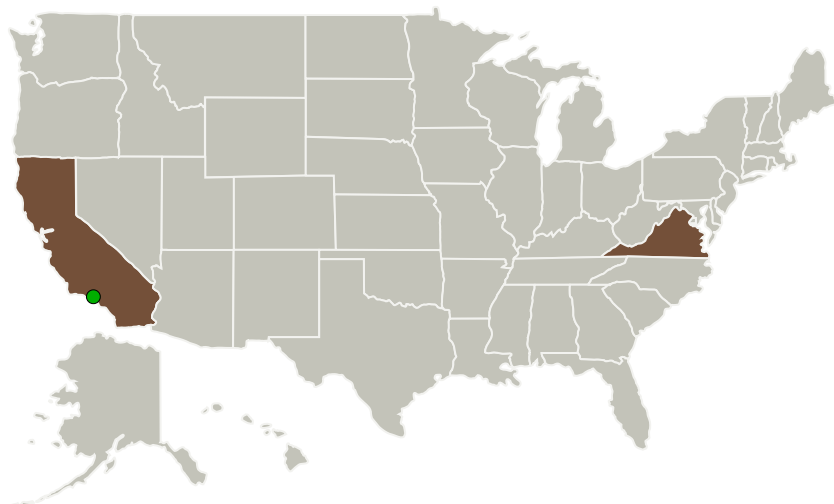


Completed Technology Project (2012 - 2014)

## Project Introduction

□ Laser beacons with scalable powers are needed for ground to deep-space optical communication uplinks. They serve as absolute reference for tracking of spacecraft during the downlink laser communication. For such space communication link distances the beam spread due to diffraction is significant enough that only few photons are collected by a moderate size optical telescopes on the spacecraft. This necessitates photon-counting detectors suited for the space environment, along with increasing the output power of the laser beacon. Ultra low noise silicon avalanche photo-detector (Si-APD) based position-sensing detectors are used on the spacecraft to detect the laser beacons. Such Si-APDs are also radiation-hardened and compatible with space-environment operation. It is therefore desirable to operate at shorter wavelengths  $\sim 1000\text{nm}$ , where Si-APDs have improved spectral responsivity. This helps to improve the SNR for tracking, and consequently reduce the uplink laser power requirements. Under Phase 2 program Fibertek will design and build a single-channel uplink laser beacon transmitter operating at  $1030\text{nm}$ , capable of  $500\text{W}$  average output power and  $500\text{kHz}$  16-PPM arby format operation. Inputs from end-user will be solicited for intended use and application, so as to drive the design requirements. Baseline multi-stage  $1024\text{nm}$   $300\text{W}$  Yb-fiber amplifier architecture demonstrated in Phase 1 will be transitioned to highly robust 'all-fiber' configuration. Proposed design and prototype hardware is based on COTS fiber-optic technology platform, thereby leading to TRL = 4 - 5 level for the SBIR Phase 2 deliverable.

## Primary U.S. Work Locations and Key Partners



## Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Organizational Responsibility	1
Project Management	1
Project Transitions	2
Images	2
Technology Maturity (TRL)	2
Technology Areas	2
Target Destinations	2

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Fibertek, Inc.

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

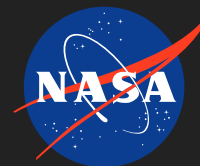
Jason L Kessler

### Program Manager:

Carlos Torrez

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Organizations Performing Work	Role	Type	Location
Fibertek, Inc.	Lead Organization	Industry	Herndon, Virginia
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Virginia

## Project Transitions

**April 2012:** Project Start**September 2014:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/138334>)

## Images

**Project Image**

Multi-kW Uplink Fiber-Laser Beacon with Agile Signal Format  
(<https://techport.nasa.gov/image/136910>)

Project Management  
(cont.)**Principal Investigator:**

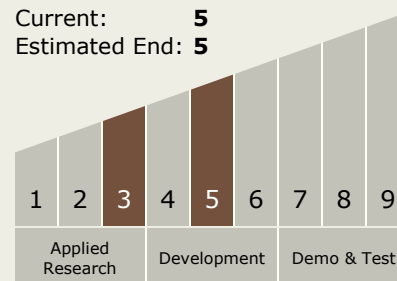
James H Phillips

**Co-Investigator:**

James D Phillips

Technology Maturity  
(TRL)

Start: 3  
Current: 5  
Estimated End: 5



## Technology Areas

**Primary:**

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.1 Optical Communications
    - TX05.1.3 Lasers

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System